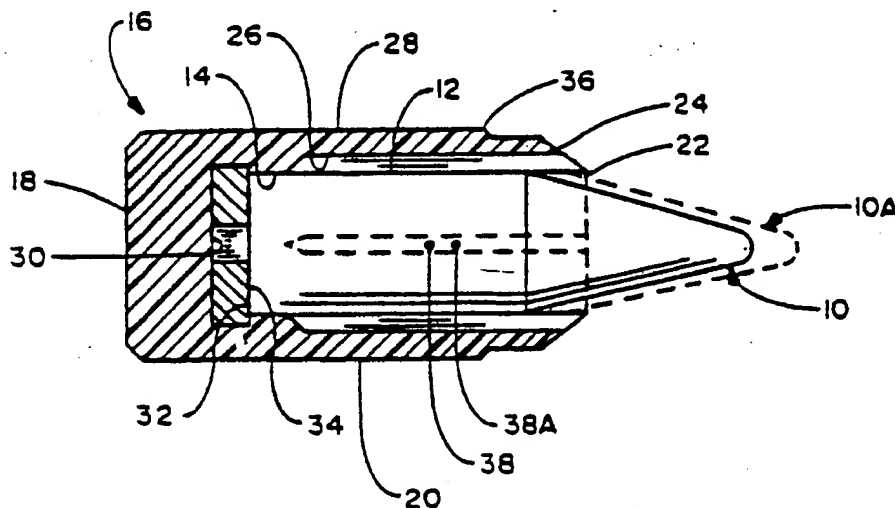




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification: F42B 13/16	A1	(11) International Publication Number: WO 87/05386 (43) International Publication Date: 11 September 1987 (11.09.87)
(21) International Application Number: PCT/US86/00491 (22) International Filing Date: 10 March 1986 (10.03.86) (71) Applicant: OLIN CORPORATION [US/US]; Winchester Group, 120 Long Ridge Road, Stamford, CT 06904-1355 (US). (72) Inventor: HALVERSON, Henry, J.; 25 Bellevue Drive, Collinsville, IL 62234 (US). (74) Agent: BURDICK, Bruce, E.; Olin Corporation, Winchester Group, Shamrock Street, (Bldg. T-189), East Alton, IL 62024 (US).		(81) Designated States: AT (European patent), AU, BE (European patent), BR, CH (European patent), DE (European patent), DK, FI, FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), NO, SE (European patent). Published With international search report. With amended claims.

(54) Title: HIGH VELOCITY AMMUNITION SABOT



(57) Abstract

A high velocity ammunition sabot (16) of brittle material which has sufficient strength to withstand the forces of being launched from a rifled gun barrel but which fragments almost immediately upon exit from the barrel due to centrifugal forces. A polyetherimide material is preferred, although materials of equivalent properties could be used.

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HIGH VELOCITY AMMUNITION SABOT

BACKGROUND AND SUMMARY OF THE INVENTION

This invention relates to ammunition sabots and particularly to a disintegrating sabot.

"Small caliber" as used herein means 0.50" caliber and below. The state of the art in plastic small caliber sabots has basically remained static since the development of the plastic sabot for hunting ammunition shown in U.S. Patent No. 3,164,092, issued January 5, 1965, to D. S. Reed et al and assigned to Remington Arms Co., Inc. and which relates to the well-known Remington "Accelerator" hunting cartridge which uses a lead bullet in a polycarbonate sabot.

There is a constant desire to increase the speed, hardness, and density of lightweight subcaliber rifle bullets so that they will penetrate harder and thicker targets. However, it has not been known how to do this in conventional rifles due to the denser bullet materials that are required and the inability of existing sabots such as that taught by the Reed et al patent above to withstand the forces imposed by such launches of subcaliber projectiles having higher sectional density and hardness than the soft lead hunting bullets taught by the Reed et al patent.

The present invention provides a solution to this problem by providing an ammunition sabot which is strong enough to exit a rifled barrel in one piece at peak chamber pressures in excess of 70,000 copper crusher units of

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pressure (C.U.P.) while carrying a tungsten or tungsten carbide penetrator and then immediately disintegrate so that it doesn't thereafter slow down the projectile or make the projectile inaccurate. In the present invention, this is accomplished by use of a special sabot material (see Claims 1-4) and/or a special sabot design (see Claims 5-12).

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood by reference to the attached drawing in which:

FIGURE 1 is a cross-sectional view taken along the axis of a preferred sabot and projectile of the invention; and

FIGURE 2 is an isometric view of the washer of FIGURE 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A projectile 10 is shown having a major cylindrical rear portion 12 carried with a central recess 14 of a generally cylindrical plastic sabot 16 which has a solid cylindrical rear base portion 18 and a tubular front portion 20. Front portion 20 comprises a plurality of arcuate cylindrical portions 22 connected by weakened portions 24 extending axially on portion 20. Weakened portions 24 are weakened by suitable means such as spaced axial grooves or notches 26 on the inner periphery of central recess 14. Notches 26 run from the front end of sabot 16 part way back on the inner periphery of front portion 20. The outer periphery 28 of sabot 16 is an uninterrupted right cylindrical surface.

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Between the floor 30 of recess 14 of sabot 16 and the rear end 32 of projectile 10 is a metallic square washer with rounded corners 34 (also shown in FIGURE 2) which extends radially inward and outward of the inner periphery of central recess 14 so as to distribute the accelerational forces during explosive discharge of sabot 16 and projectile 10 together through a rifled gun barrel (not shown) and to prevent rotational slippage between sabot 16 and washer 34 during spin-up of sabot 16 during such discharge. Washer 34 could be of other non-circular symmetrical shapes such as polygonal, (pentagonal, or hexagonal, etc.), oval, or gear-shaped. Washer 34 has rounded corners to reduce stress concentrations at its corners and to allow use of bigger area washers.

Outer periphery of 28 of sabot 16 is of a substantially constant diameter from base 18 up to an axial point 36 which is located forward of the center of gravity 38 of projectile 10 to minimize balloting of projectile 10 during its passage through a rifled gun barrel, as might occur if point 36 was located back of center of gravity 38. A second optional heavy projectile 10a is also shown having a center of gravity 38a, which is also behind point 36.

Sabot 16 is of 7.62mm caliber and carries a 52 grain tungsten projectile 10 or a 57 grain tungsten projectile 10a. Other calibers of sabot 16 such as 5.56mm or 0.50 caliber could also be utilized and other sizes, materials, and shapes of projectiles 10 could be utilized, if desired.

The plastic for sabot 10 is of a material that has sufficient tensile strength (at least 12,000 psi), compressive strength (at least 15,000 psi), and sufficient

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shear strength (at least 12,000 psi) to withstand the shock of explosive discharge from a rifled gun barrel while carrying projectile 10 but having insufficient (less than about 12 ft.-lbs./in.) Izod impact strength to withstand centrifugal and aerodynamic forces following discharge so that sabot 16 disintegrates immediately (i.e., within a yard) after exiting the barrel muzzle, thus immediately freeing the projectile 10 for unimpeded flight to the target.

One suitable plastic material is "ULTEM 1000", an unreinforced amorphous polyetherimide thermoplastic resin marketed by General Electric Company. Some other plastics believed to be suitable are ULTEM 2200, a 20% glass reinforced polyetherimide resin and LEXAN 3412, a 20% glass reinforced polycarbonate resin, both from General Electric Company and TORLON 4203L engineering resin from Amoco Chemicals Corporation. Other plastics with equivalent mechanical properties could be utilized if the mechanical properties of the plastic are not chemically deteriorated by any exposure to propellants with which it is expected to be utilized.

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WHAT IS CLAIMED IS:

1. A small caliber spin stabilized, frangible discarding sabot projectile comprising:

a hard metallic armor-penetrator subcaliber core; and

a cylindrical sabot having a central recess in a front end thereof surrounding a rear portion of said penetrator and having a solid base portion behind said core, said sabot being made of a material with an Izod impact strength of less than 12 ft. lbs./in. of notch when tested under ASTM Test Method D256, a compressive strength of at least 15,000 psi when tested under ASTM Test Method D695, a shear strength of at least 12,000 psi when tested under ASTM Test Method D732 and a tensile strength of at least 12,000 psi when tested under ASTM Test Method D1708.

2. The projectile of Claim 1 wherein said sabot material is an amorphous polyetherimide resin thermoplastic.

3. The projectile of Claim 1 wherein said sabot material is a polycarbonate thermoplastic resin reinforced with glass fibers.

4. The projectile of Claim 1 wherein said sabot material is a polyetherimide reinforced with glass fibers.

5. A unitary sabot for projection of a hard metallic subcaliber projectile through a rifled gun barrel, said sabot comprising:

a cylindrical plastic body having a rear base portion and front portion with a cylindrical

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defining a tubular frontal projection adapted to surround and receive a major rear portion of said projectile, said sabot being of a plastic material which is of sufficient compressive and shear strength to withstand the shock of explosive discharge from said barrel while carrying the projectile in said recess but having insufficient impact strength to withstand centrifugal and aerodynamic forces following the discharge so that after the discharge said projection immediately disintegrates to free said projectile.

6. The sabot of Claim 5 wherein said projection comprises:

a plurality of arcuate cylindrical segments connected by weakened portions extending axially on said projection.

7. The sabot of Claim 6 wherein said weakened portions are spaced axial grooves on the inner periphery of said projection, and the outer periphery of said sabot is uninterrupted, whereby said projection can assist in obturation of said barrel.

8. The sabot of Claim 7 further comprising:

a symmetrical, noncircular centrally perforated flat metallic plate at the base of said central recess and extending radially inward and outward of the inner periphery of said recess, so as to distribute the accelerational forces during said explosive discharge through said rifled barrel and

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prevent rotational slippage of said plate in said sabot during spin-up of the sabot.

9. The sabot of Claim 6 further comprising:
a symmetrical non-circular centrally perforated flat metallic plate at the base of said central recess and extending radially inward and outward of the inner periphery of said recess, so as to distribute the accelerational forces during said explosive discharge through said rifled barrel and prevent rotational slippage of said plate in said sabot during spin-up of the sabot.

10. The sabot of Claim 5 further comprising:
a symmetrical non-circular centrally perforated flat metallic plate at the base of said central recess and extending radially inward and outward of the inner periphery of said recess, so as to distribute the accelerational forces during said explosive discharge through said rifled barrel and prevent rotational slippage of said plate in said sabot during spin-up of the sabot.

11. The sabot of Claim 5 wherein said recess contains a subcaliber projectile and said projection has the same outer diameter as the rear portion of said sabot at least up to the axial location of the axial center of gravity of said projectile so as to help prevent sabot balloting during discharge through the barrel.

12. The sabot of Claim 1 wherein said sabot has a diameter less than 0.50 inches.

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13. A plastic small caliber sabot for projection of a subcaliber projectile through a rifled gun barrel, said sabot comprising:

a cylindrical plastic body having a rear base portion and a front portion with a central cylindrical recess in said front portion thus defining a tubular frontal projection adapted to surround and receive a major rear portion of said projectile; and

a polygonal centrally perforated flat metallic plate at the base of said central recess and extending radially inward and outward of the inner periphery of said recess, so as to distribute the accelerational forces during said explosive discharge through said rifled barrel and prevent rotational slippage of said plate in said sabot during spin-up of the sabot.

14. The sabot of Claim 13 wherein said metallic plate is square with rounded corners.

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AMENDED CLAIMS

[received by the International Bureau on 22 September 1986 (22.09.86);
original claims 6 and 7 amended; other claims unchanged (1 page)]

defining a tubular frontal projection adapted to surround and receive a major rear portion of said projectile, said sabot being of a plastic material which is of sufficient compressive and shear strength to withstand the shock of explosive discharge from said barrel while carrying the projectile in said recess but having insufficient impact strength to withstand centrifugal and aerodynamic forces following the discharge so that after the discharge said projection immediately disintegrates to free said projectile.

6. The sabot of Claim 5 wherein the frontal projection comprises:

a plurality of arcuate cylinder segments connected by spaced axial notches on an inner surface of the projection and a smooth circumferentially uninterrupted external surface, the notches extending axially only part way from the front of the projection toward the base of the recess and having a pointed rear end to concentrate stresses and direct the separation of the segments along a relatively predictable path.

7. The sabot of Claim 6 wherein the outer surface of the sabot is of a reduced diameter from the front of the sabot rearwardly to a point forward of the center of gravity of the projectile so as to further weaken the front of the sabot to promote separation of the segments following launch while still providing sufficient bourrelet surface to minimize balloting of the projectile during launch.

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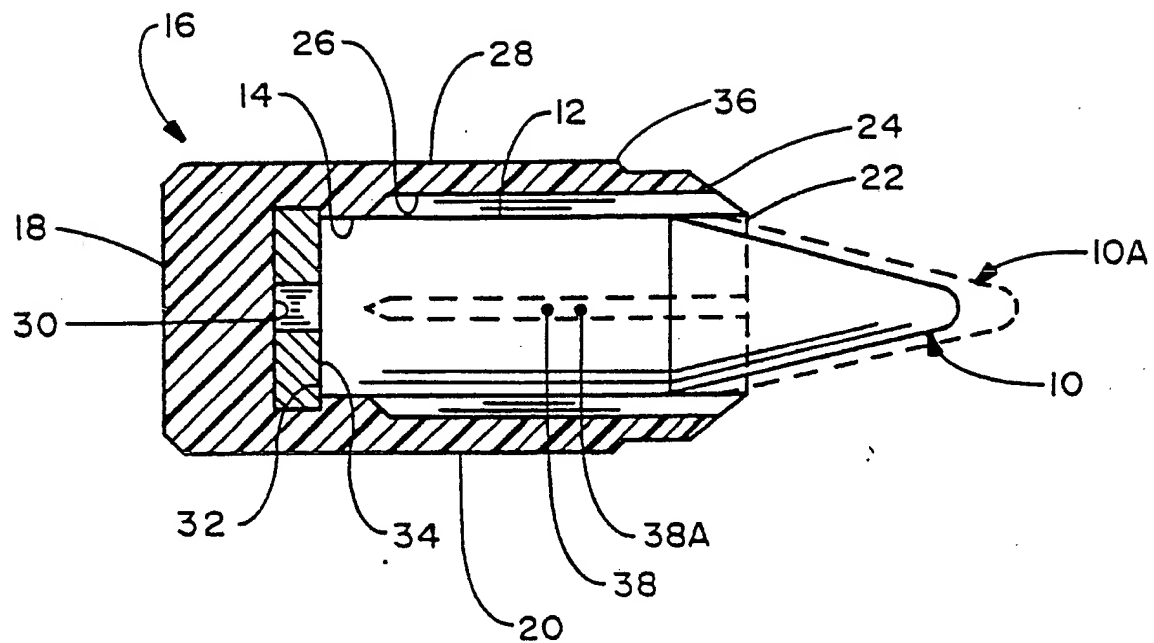


FIG. 1



FIG. 2

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INTERNATIONAL SEARCH REPORT

International Application No PCT/US 86/00491

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) *

According to International Patent Classification (IPC) or to both National Classification and IPC

Int C14 F42B 13/16

US C1 102/520

II. FIELDS SEARCHED

Minimum Documentation Searched *

Classification System

Classification Symbols

US

102/520-523,532

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched *

III. DOCUMENTS CONSIDERED TO BE RELEVANT ¹⁴

Category *	Citation of Document, ¹⁵ with indication, where appropriate, of the relevant passages ¹⁷	Relevant to Claim No. ¹⁸
Y	US, A, 3,164,092, Reed et al, 5 Jan. 1965, See lines 40-56 of col.3.	1-14
Y	US, A, 4,239,006, Kelson, 16 Dec. 1980, See lines 11-21 of col. 1.	2,4
Y	US, A, 4,187,271, Rolston et al 5 Feb. 1980, see entire document	3,4
Y	US, A, 4,488,491, Rhodes, 18 Dec. 1984, see entire document	5-14
Y	US, A, 3496,869 Engel 24 Feb. 1970, see entire document	6-9
A	US, A 4,148,259, Yuhash et al. 10 Apr. 1979	

* Special categories of cited documents: ¹⁶

"A" document defining the general state of the art which is not considered to be of particular relevance

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

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IV. CERTIFICATION

Date of the Actual Completion of the International Search *

22 July 1986

Date of Mailing of this International Search Report *

07 AUG 1986

International Searching Authority ¹

ISA/US

Signature of Authorized Officer ²⁰

Harold Tudor